

LISTING OF THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) In combination with an acting element for exerting a predetermined action on a chemical solution, a chemical pump for pumping said chemical solution through said acting element, comprising:

a pressure chamber divided by a movable partition member into a first chamber and a second chamber; ~~and~~

a single driving element for driving said partition member to reciprocate, thereby changing a volume ratio between said first chamber and said second chamber while the sum of the volumes of said first and second chambers is held constant; and [-]

a pipe provided outside said pressure chamber, for passing said chemical solution between said first chamber and said second chamber,

wherein said single driving element drives said partition member in such a manner that, when the volume of said first chamber decreases, the decreased volume of said first chamber is equal to an increased volume of said second chamber, and when the volume of said first chamber increases, the increased volume of said first chamber is equal to a decreased volume of said second chamber, and

~~[wherein]~~ the chemical solution sucked and introduced into said first chamber by driving said partition member in a first direction is moved via said acting element inserted in said pipe ~~[provided outside said pressure chamber]~~ into said second chamber by driving said partition member in a second direction, and is then discharged out of said second chamber by driving said partition member in said first direction again.

2. (Original) The chemical pump according to claim 1, wherein said single driving element drives said partition member by means of a driving force of a motor.

3. (Currently Amended) The chemical pump according to claim 1, wherein said acting element is a filter element~~[-and said filter element is inserted in a pipe outside said pressure chamber for providing communication between said first chamber and said second chamber].~~

4. (Currently Amended) A piping system for directing a chemical solution ~~[through a pipe]~~ to a predetermined processing part, comprising:
a pipe serving as a flow passage of said chemical solution;
a switching element for switching an ~~[[the]]~~ operating mode of said piping system between a maintenance mode for purging air from said pipe and a normal mode for directing said chemical solution to said predetermined processing part; and
an opening and closing element for opening and closing said pipe in accordance with said operating mode switched by said switching element,
said pipe being connected to a chemical pump, said chemical pump being used in combination with an acting element for exerting a predetermined action on said chemical solution, said chemical pump pumping said chemical solution through said acting element,
said chemical pump including
a pressure chamber divided by a movable partition member into a first chamber and a second chamber, and
a single driving element for driving said partition member to reciprocate, thereby changing a volume ratio between said first chamber and said second chamber while the sum of the volumes of said first and second chambers is held constant,
wherein said single driving element drives said partition member in such a manner that, when the volume of said first chamber decreases, the decreased volume of said first chamber is equal to an increased volume of said second chamber, and when the volume of said first chamber increases, the increased volume of said first chamber is equal to a decreased volume of said second chamber, and
~~[wherein]~~ the chemical solution sucked and introduced into said first chamber by driving said partition member in a first direction is moved via said acting element inserted in said pipe

~~[provided outside said pressure chamber]~~ into said second chamber by driving said partition member in a second direction, and is then discharged out of said second chamber by driving said partition member in said first direction again.

5. (Currently Amended) A substrate processing unit comprising:

- (a) a holding part for holding a substrate;
- (b) a nozzle for discharging a chemical solution onto said substrate held by said holding part;
- (c) a chemical solution reservoir for storing said chemical solution to be supplied to said nozzle;
- (d) a piping system for directing said chemical solution to a predetermined processing part, said piping system including ~~[a chemical pump, used in combination with an acting element for exerting a predetermined action on said chemical solution, for pumping said chemical solution through said acting element, said chemical pump including]~~
 - (d-1) a pipe serving as a flow passage of said chemical solution, ~~[a pressure chamber divided by a movable partition member into a first chamber and a second chamber, and]~~
 - (d-2) a switching element for switching an operating mode of said piping system between a maintenance mode for purging air from said pipe and a normal mode for directing said chemical solution to said predetermined processing part, and ~~[a single driving element for driving said partition member to reciprocate, thereby changing a volume ratio between said first chamber and said second chamber while the sum of the volumes of said first and second chambers is held constant, and]~~
 - (d-3) an opening and closing element for opening and closing said pipe in accordance with said operating mode switched by said switching element; and
- (e) a chemical pump, connected to said pipe and used in combination with an acting element for exerting a predetermined action on said chemical solution, for pumping said chemical solution through said acting element, said chemical pump including ~~[a piping system for directing said chemical solution through a pipe connected to said chemical pump to a predetermined processing part, said piping system including]~~

(e-1) a pressure chamber divided by a movable partition member into a first chamber and a second chamber ~~[a switching element for switching the operating mode of said piping system between a maintenance mode for purging air from said pipe and a normal mode for directing said chemical solution to said predetermined processing part]~~, and

(e-2) a single driving element for driving said partition member to reciprocate, thereby changing a volume ratio between said first chamber and said second chamber while the sum of the volumes of said first and second chambers is held constant ~~[an opening and closing element for opening and closing said pipe in accordance with said operating mode switched by said switching element]~~,

wherein said single driving element drives said partition member in such a manner that, when the volume of said first chamber decreases, the decreased volume of said first chamber is equal to an increased volume of said second chamber, and when the volume of said first chamber increases, the increased volume of said first chamber is equal to a decreased volume of said second chamber, and

~~[wherein]~~ the chemical solution sucked and introduced into said first chamber by driving said partition member in a first direction is moved via said acting element inserted in said pipe ~~[provided outside said pressure chamber]~~ into said second chamber by driving said partition member in a second direction, and is then discharged out of said second chamber by driving said partition member in said first direction again.

6. (Currently Amended) A substrate processing apparatus for performing a series of processes upon a substrate, comprising:

- (a) a substrate processing unit including
 - (a-1) a holding part for holding a substrate,
 - (a-2) a nozzle for discharging a chemical solution onto said substrate held by said holding part,
 - (a-3) a chemical solution reservoir for storing said chemical solution to be supplied to said nozzle,
 - (a-4) a piping system for directing said chemical solution to a predetermined processing

~~part, said piping system including [a chemical pump, used in combination with an acting element for exerting a predetermined action on said chemical solution, for pumping said chemical solution through said acting element, said chemical pump including]~~

~~(a-4-1) a pipe serving as a flow passage of said chemical solution, [a pressure chamber divided by a movable partition member into a first chamber and a second chamber, and]~~

~~(a-4-2) a switching element for switching an operating mode of said piping system between a maintenance mode for purging air from said pipe and a normal mode for directing said chemical solution to said predetermined processing part, and [a single driving element for driving said partition member to reciprocate, thereby changing a volume ratio between said first chamber and said second chamber while the sum of the volumes of said first and second chambers is held constant, and]~~

~~(a-4-3) an opening and closing element for opening and closing said pipe in accordance with said operating mode switched by said switching element, and~~

~~(a-5) a chemical pump, connected to said pipe and used in combination with an acting element for exerting a predetermined action on said chemical solution, for pumping said chemical solution through said acting element, said chemical pump including [a piping system for directing said chemical solution through a pipe connected to said chemical pump to a predetermined processing part, said piping system including]~~

~~(a-5-1) a pressure chamber divided by a movable partition member into a first chamber and a second chamber [a switching element for switching the operating mode of said piping system between a maintenance mode for purging air from said pipe and a normal mode for directing said chemical solution to said predetermined processing part], and~~

~~(a-5-2) a single driving element for driving said partition member to reciprocate, thereby changing a volume ratio between said first chamber and said second chamber while the sum of the volumes of said first and second chambers is held constant [an opening and closing element for opening and closing said pipe in accordance with said operating mode switched by said switching element];~~

(b) a development processing unit for performing a development process on said substrate;

(c) a heat treatment unit for performing heat treatment on said substrate; and

(d) a transport element for transporting said substrate between said units,

wherein said single driving element drives said partition member in such a manner that, when the volume of said first chamber decreases, the decreased volume of said first chamber is equal to an increased volume of said second chamber, and when the volume of said first chamber increases, the increased volume of said first chamber is equal to a decreased volume of said second chamber, and

[~~wherein~~] the chemical solution sucked and introduced into said first chamber by driving said partition member in a first direction is moved via said acting element inserted in said pipe [~~provided outside said pressure chamber~~] into said second chamber by driving said partition member in a second direction, and is then discharged out of said second chamber by driving said partition member in said first direction again.

7. (Withdrawn) A method of sucking and discharging a chemical solution, comprising the steps of:

driving in a first direction a movable partition member having opposite surfaces approximately equal in surface area within a pressure chamber divided by said partition member into a first chamber and a second chamber on opposite sides of said partition member, to increase the volume of said first chamber while decreasing the volume of said second chamber, thereby sucking and introducing said chemical solution into said first chamber;

driving said partition member in a second direction within said pressure chamber to decrease the volume of said first chamber while increasing the volume of said second chamber, thereby moving said chemical solution from said first chamber to said second chamber via an acting element provided outside said pressure chamber for exerting a predetermined action on said chemical solution; and

causing said partition member to increase the volume of said first chamber again while decreasing the volume of said second chamber again, thereby discharging said chemical solution out of said second chamber.

8. (Withdrawn) A method of directing a chemical solution through a pipe to a predetermined processing part, comprising the steps of:

(a) discharging said chemical solution to drive said chemical solution in a predetermined direction, said step (a) including the sub-steps of

(a-1) driving in a first direction a movable partition member having opposite surfaces approximately equal in surface area within a pressure chamber divided by said partition member into a first chamber and a second chamber on opposite sides of said partition member, to increase the volume of said first chamber while decreasing the volume of said second chamber, thereby sucking and introducing said chemical solution into said first chamber,

(a-2) driving said partition member in a second direction within said pressure chamber to decrease the volume of said first chamber while increasing the volume of said second chamber, thereby moving said chemical solution from said first chamber to said second chamber via an acting element provided outside said pressure chamber for exerting a predetermined action on said chemical solution, and

(a-3) causing said partition member to increase the volume of said first chamber again while decreasing the volume of said second chamber again, thereby discharging said chemical solution out of said second chamber; and

(b) directing said chemical solution driven in said step (a) through said pipe, said step (b) including the sub-steps of

(b-1) purging air from said pipe for maintenance,
(b-2) directing said chemical solution to said predetermined processing part,
(b-3) opening and closing a valve provided in a predetermined position of said pipe, and
(b-4) switching between said sub-step (b-1) and said sub-step (b-2) by opening and closing said valve in said sub-step (b-3).

9. (Withdrawn) A method of supplying a chemical solution to a substrate to perform a predetermined process on said substrate, comprising the steps of:

(a) holding said substrate;

(b) discharging said chemical solution to drive said chemical solution in a predetermined direction, said step (b) including the sub-steps of

(b-1) driving in a first direction a movable partition member having opposite surfaces approximately equal in surface area within a pressure chamber divided by said partition member into a first chamber and a second chamber on opposite sides of said partition member, to increase the volume of said first chamber while decreasing the volume of said second chamber, thereby sucking and introducing said chemical solution into said first chamber,

(b-2) driving said partition member in a second direction within said pressure chamber to decrease the volume of said first chamber while increasing the volume of said second chamber, thereby moving said chemical solution from said first chamber to said second chamber via an acting element provided outside said pressure chamber for exerting a predetermined action on said chemical solution, and

(b-3) causing said partition member to increase the volume of said first chamber again while decreasing the volume of said second chamber again, thereby discharging said chemical solution out of said second chamber;

(c) directing said chemical solution driven in said step (b) through said pipe, said step (c) including the sub-steps of

(c-1) purging air from said pipe for maintenance,

(c-2) directing said chemical solution to said predetermined processing part,

(c-3) opening and closing a valve provided in a predetermined position of said pipe, and

(c-4) switching between said sub-step (c-1) and said sub-step (c-2) by opening and closing said valve in said sub-step (c-3); and

(d) discharging said chemical solution directed in said step (c) onto said substrate held in said step (a).

10. (New) The chemical pump according to claim 1, wherein
said partition member prevents passage of said chemical solution between said first chamber and said second chamber inside said pressure chamber.

11. (New) The chemical pump according to claim 1, wherein each of said first chamber and said second chamber is provided with a single sucking opening and a single discharging opening.